an internal cooling circuit extending between the inlet port and the outlet port, the cooling circuit including first and second channels, the first and second channels each having a first end connected to the inlet port, and a second end connected to the outlet port, the first channel extending through the wall sections from the inlet port to the outlet port in a first direction, the second channel extending through the wall sections from the inlet port to the outlet port in a substantially opposite direction from the first channel such that in operation flow though the first and second channels are in opposite directions.

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23. (New) A heat transfer apparatus according to claim 22 wherein the first ends of the first and second channel are connected to the inlet port through a splitter, and wherein the splitter is formed in the same wall section as the inlet port; and wherein the second ends of the first and second channel are connected to the outlet port through a splitter, and wherein the splitter is formed in the same wall section as the outlet port.

24. (New) A heat transfer apparatus according to claim 22 wherein the inlet port and the outlet port are formed in the same wall section.

REMARKS

Claims 1-14 were pending. Claims 15-18 have been withdrawn. Claims 2, 10 and 13 have been canceled in the response. Claims 19-24 are new. Claims 1, 3-7, 9-12, and 14 have been amended to clarify the invention. No new matter has been added to the application through these amendments.

Election

The Examiner has requested a formal acknowledgement of the election of claims in this application. As stated in the prior response filed in this application, Applicant elects Group I, claims 1 through 14 for examination.

Information Disclosure Statement

It is noted that the Examiner has not considered the SAE and ASTM standards identified

in the Background section of the specification. Those standards were merely cited to provide background related to the field of the present invention and are not considered pertinent as prior art.

Drawings

The drawings were objected to for not identifying the hybrid heat transfer system. Figure 3 has been amended to include reference numeral 11. A redlined version of the change to Figure 3 is being provided with this response. Formal approval by the Examiner of the change is requested. The specification has also been amended to appropriately refer to the numeral 11.

Claim Objections

The Examiner has suggested modifications to claims 1 and 9. These claims have been amended to address the Examiner's objection.

§112 Claim Rejections

Claims 2-14 were rejected under 35 USC §112 as being indefinite on pages 5-7 of the Office Action. The Examiner contends that some of the recited terms were unclear. Applicant disagrees. However, to address the Examiner's concerns a number of the claims have been amended to remove any purported indefiniteness. It is respectfully submitted that the claims are definite as required under 35 USC §112.

Turning to the specific rejections, claims 2 and 10 have been canceled, thus obviating the §112 rejections related to those claims. Claims 4 and 5 have been amended to clearly identify the passages as the prior recited first two passages. Regarding claim 6, the recitation of the hybrid heat transfer system has been removed from the claim, thus removing the cause of the Examiner's concern.

Regarding claims 7 and 8, the Examiner objects to these claims as lacking a specific element for providing electric current. Applicant notes that these claims correctly do not include such a component. Since the electric current is not expressly claimed, there is no need for a current supply source. Claim 7 has been clarified to clearly note that the current is not a positively recited component of the claim. As claimed, the heat exchanging element is a thermoelectric module which is adapted to receive electric current for controlling heat transfer

through the module. Since the current is not positively recited in the claim, there is no need for a separate power source.

The Examiner has rejected claim 9 contending that it is not clear regarding the structure that corresponds to the heat exchanging element. It is not readily apparent from the office action what the Examiner is unclear about. The heat exchanging element in claim 9 is the structure claimed. Those skilled in the art are well aware of the different types of devices that are called "heat exchangers." Claim 9 additionally requires that the heat exchanging element is adapted to receive electric current for transferring heat to or from the receptacle. This language further defines the type of heat exchanger that is claimed, i.e., one that requires supply of electric current to effect the transfer of heat. As described in the specification, one preferred type of heat exchanging element is a thermoelectric module (i.e., a Peltier device).

Claim 9 was also rejected as purportedly lacking an essential element, namely an electrical current source. As with claim 7, claim 9 does not, and there was no intention to, include an electrical current source. Since the electric current is not expressly claimed, there is no need for a current supply source. To address the Examiner's concerns, claim 9 has been clarified to clearly note that the current is not an express component of the claim. As claimed, the heat exchanging element is adapted to receive electric current for controlling heat transfer to or from the receptacle by means of the heat exchanging element. Since the current is not positively recited in the claim, there is no need for a separate power source.

In light of the above discussion and the clarifications made to claim 9, it is respectfully submitted that this claim is clear and meets all the requirements of §112.

Claim 14 was similarly rejected for not reciting certain structure. The claim has been amended to clarify the structural association of the claimed elements. Specifically, the temperature probe provides a signal to the temperature control system. The control system is in electrical communication with the heat exchanging element and adapted to receive the signal from the temperature probe. That signal is used to control the current to the heat exchanging element. It is respectfully submitted that claim 14 as written meets all the requirements set forth in §112.

Based on the foregoing, reconsideration and withdrawal of the rejections and objections is respectfully requested.

§102 Rejections

Claims 1, 6-8 have been rejected under 35 USC § 102(b) as being anticipated by U.S. Pat. No. 4,346,754 to Imig et al. The Examiner has taken the position that Imig et al discloses each and every element of the rejected claims. In light of the clarifications made to the claims to identify the arrangement of the channels or passages so as to provide a counter flow, it is respectfully submitted that the claims are not anticipated by nor obvious over Imig et al.

Imig et al. discloses a heating and cooling system for a fatigue testing machine. The system includes a clamping mechanism with two halves 10 that sandwich a specimen being fatigue tested. The system includes a plumbing system for channeling a supply of coolant (such as nitrogen) into a half of the clamping device. Specifically, the coolant supply enters the bottom of one half 10 of the clamping mechanism at an inlet 18. The coolant is channeled into the upwardly extending cooling passages 14 and then directed out of the block via outlet 19.

The heating system in Imig et al. is provided by two heating cartridges 13 which are located outward from the cooling passages, i.e., the cooling passages are located between the heating element and the specimen.

The present invention is directed to a unique and novel heat transfer apparatus system for controlling the temperature of a sample placed in the apparatus. The apparatus includes a heat conveying member that includes two passages formed in it that are adapted to convey or channel a heat transfer medium (e.g., coolant) through the member. In one embodiment, the heat conveying members includes a plurality of heat sinks connected together to form an enclosure or cavity for the receptacle. The passages are connected together through a splitter to an inlet and through a union to an outlet. The passages extend in opposite direction from one another through the member, thus providing counter flow during use.

The present invention was developed to address some specific deficiencies with prior art testing methods. The arrangement provided by the present invention provides controlled and efficient heat dissipation, equalizing the hot side temperature to which the sample is exposed.

The present invention also permits the use of thermoelectric modules. Generally such modules are sensitive to moisture, which can lead to electrochemical corrosion in the module. This is primarily due to the fact that moisture (in its vapor state) can still penetrate into silicon. So thermoelectric modules must be sufficiently sealed to prevent passage of moisture.

The invention recited in claim 1 is neither anticipated by nor obvious over Imig et al.

Imig does not include a splitter nor a union in the heat conveying member. The only splitter in Imig et al. that splits the flow into two passages is located external to the heat conveying member, and there is no union. As shown in the figures in Imig et al., the flow through the inlet empties into a internal passage 14 that appears to be essentially continuous to the outlet 19. There are no split passages. Furthermore, the flow in the passage 14 is in a single direction, thus the passages cannot extend in opposite directions. Hence, not only is claim 1 not anticipated by Imig et al., but there is no logical way to modify Imig et al. to make it work. Thus, claim 1 is patentable over the Imig et al. reference.

Claims 3-8 depend from claim 1 and recite additional features which are not disclosed or obvious in view of Imig et al. These claims are, therefore, patentable over Imig et al.

Claims 1, 6-9 and 14 have been rejected under 35 USC § 102(b) as being anticipated by U.S. Pat. No. 4,502,531 to Petersen. The Examiner has taken the position that Petersen discloses each and every element of these claims. In light of the clarifications made to the claims to identify the arrangement of the channels or passages so as to provide a counter flow, it is respectfully submitted that the claims are not anticipated by nor obvious over Petersen.

Petersen is directed to a high-pressure furnace. The furnace includes an insulated vessel 33 within which is located a cavity 3. A sample container 35 is located within the cavity. A coiled tube 23 encircles the cavity for channeling coolant to cool the cavity. A coiled heating element 6 is located within the cavity for heating the sample container 35.

Claim 1 is discussed in detail above. Claim 9 is similar. These claims both recite that the heat conveying member includes a splitter and a union. Petersen does not include a splitter or a union. On the contrary, Petersen runs a single coolant line that coils about the cavity. Thus, for this reason alone Petersen fails to teach the claimed invention. Petersen also does not include any union nor passages that extend in opposite directions through the heat conveying member. The coiled coolant line goes in a single direction (and must do so in light of its unitary structure.) Thus, independent claims 1 and 9 are patentable over Petersen.

Claims 3-8 and 14 depend from claims 1 and 9. These claims recite additional features that are not disclosed nor suggested by Petersen. These claims are also, therefore, patentable over Petersen.

Based on the foregoing, reconsideration and withdrawal of the §102 rejection of claims 1-

9, and 14 is respectfully requested.

New Claims

Claims 19-24 have been added to the application. These claims are also patentable over Imig et al. and Petersen. Neither Imig nor Petersen include an inlet with a splitter and two passages extending in opposite directions for channeling a cooling liquid. These claims include additional features which further distinguish the claims over Imig et al. and Petersen. Accordingly, it is respectfully submitted that these claims are patentable over Imig et al. and Petersen.

If there is any question about this response or should the Examiner believe that direct communication with Applicants' representative will assist in the prosecution of this case, the Examiner is invited to contact the undersigned.

Respectfully submitted,
ZHENG ET AL.

By: _____

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Appendix

Marked up changes to specification and claims.

In the Specification:

Page 7, lines 6-12, replace the paragraph with the following:

The test cell 10 of the cold cranking simulator includes a hybrid heat transfer system 11 in which heat transfer from the block 26 to cool the test sample is provided by a first heat transfer system 36. The heat transfer provided by the first heat transfer system 36 is adjustable to provide for control over the temperature of the sample. The hybrid heat transfer system of the test cell 10 further includes a second heat transfer system 38 which functions to convey the heat which has been removed from block 26 by the controllable first heat transfer system 36.

In the Claims:

1. (Amended) A heat transfer apparatus for use in measuring a rheological property of a test sample, the heat transfer apparatus comprising:

a receptacle for receiving the test sample; and

a heat conveying member disposed in heat transfer relation to the receptacle, the heat conveying member [defining]including

at least two internal passages [extending substantially equidistant] spaced apart from one another through at least a portion of the heat conveying member, the internal passages having first and second ends,

an inlet,

an outlet,

a passage splitter connected to the inlet and the first ends of the two internal passages for dividing flow through the inlet into the two passages, and

a passage union connected to the outlet and the second ends of the two passages.

the passages formed so as to provide for counter-flowing circulation of a fluid through the heat transfer member.

Cancel claim 2.

3. (Amended) The heat transfer apparatus according to claim [2]1 wherein the heat conveying member [comprises]is formed from a plurality of heat sinks interconnected to one another so as to surround at least a portion of the receptacle[form an assembly of heat sinks].

4. (Amended) The heat transfer apparatus according to claim 3 wherein the two passages extend through at least a portion of each of the heat sinks,[wherein each of the heat sinks define internal passages] and wherein the heat transfer apparatus further comprises a plurality of connectors[tubular members] each extending between adjoining heat sinks and having a first end [contacting an]connecting one of the two internal passages of one of the adjoining heat sinks [and an]with one of the two[opposite second end contacting an] internal passages in the other of the adjoining heat sinks for permitting fluid to pass through the internal passages from one heat sink to the other.

5. (Amended) The heat transfer apparatus according to claim 3 wherein[a first passage in one of] the plurality of heat sinks[is located inwardly from a second passage with respect to the assembly of heat sinks] interconnect so as to define a substantially square housing for the receptacle and wherein the two internal passages extend through at least a portion of the heat sinks.

6. (Amended) The heat transfer apparatus according to claim 1 wherein [the heat conveying member is part of a hybrid heat transfer system in which]the heat transfer apparatus further comprises at least one heat exchanging element disposed in heat transfer relation to the receptacle to transfer heat to and from the receptacle, the heat conveying member being in heat transfer relation to the heat exchanging element for transferring heat to or from the heat exchanging element.

7. (Amended) The heat transfer apparatus according to claim 6 wherein the heat exchanging element comprises a thermoelectric module, the module adapted to receive [responsive to]electric current for controlling[to establish] transfer of heat through the module from a first side of the module to an opposite second side of the module.

8. The heat transfer apparatus according to claim 7 wherein the thermoelectric module comprises a multi-stage thermoelectric module.

9. (Amended) A cold cranking simulator comprising:

a receptacle for receiving a sample[of oil];

at least one heat exchanging element disposed in heat transfer relation to the receptacle, the heat exchanging element [responsive to] adapted to receive electric current for transferring heat to or from the receptacle by means of the heat exchanging element; and

a heat conveying member in heat transfer relation to the heat exchanging element for transferring heat to or from the heat exchanging element, the heat conveying member [defining] having at least two internal passages [extending substantially equidistant] spaced apart from one another through at least a portion of the heat conveying member, the internal passages having first and second ends,

an inlet,

an outlet,

a passage splitter connected to the inlet and the first ends of the two internal passages for dividing flow through the inlet into the two passages, and

a passage union connected to the outlet and the second ends of the two passages.

the passages formed so as to provide for counter-flowing circulation of a fluid.

Cancel claim 10.

11. (Amended) The cold cranking simulator according to claim [10]9 wherein the heat conveying member [comprises]is formed from a plurality of heat sinks interconnected to one another so as to surround at least a portion of the receptacle[form an assembly of heat sinks]

12. (Amended) The cold cranking simulator according to claim 11 wherein the two passages extend through at least a portion of each of the heat sinks,[wherein each of the heat sinks define internal passages] and wherein the heat transfer apparatus further comprises a plurality of connectors[tubular members] each extending between adjoining heat sinks and having a first end [contacting an]connecting one of the two internal passages of one of the adjoining heat sinks [and

an]with one of the two[opposite second end contacting an] internal passages in the other of the adjoining heat sinks for permitting fluid to pass through the internal passages from one heat sink to the other.

Cancel claim 13.

14. (Amended) The cold cranking simulator according to claim 9 further comprising a temperature control system having a temperature probe for generating a signal representing a temperature monitored by the probe, the control system being in electrical communication with the heat exchanging element and adapted to receive the signal for controlling the current for the heat exchanging element in response to the signal generated by the probe.

New Claims:

19. (New) A heat transfer apparatus for use in controlling the temperature of a sample container, the heat transfer apparatus comprising a heat transfer housing having a wall and a bottom, the wall having an inside surface defining a cavity within the housing, the wall including at least one electrical heat transfer device for controlling heat transfer from the inside surface of the wall, the wall having an inlet port, an outlet port and an internal cooling circuit that extends from the inlet port to the outlet port, the cooling circuit including first and second channels connected to the inlet port and the outlet port, the first channel extending from the inlet port in a first direction through the wall and the second channel extending to the outlet port through the wall in a substantially opposite direction from the first channel such that in operation the flow though the first and second channels are in opposite directions.

20. (New) A heat transfer apparatus according to claim 19 wherein the wall is made up of multiple sections, each wall section adapted to removably engage with two adjacent wall sections.

21. (New) A heat transfer apparatus according to claim 19 wherein the inlet and outlet ports are formed in one wall section and wherein the first and second channels extend through the other three wall sections.

22. (New) A heat transfer apparatus for use in controlling the temperature of a sample container, the heat transfer apparatus comprising

a heat transfer housing having four wall sections and a bottom, the wall sections having an inside surface defining a cavity within the housing and an outside surface;

at least two thermal electrical units mounted in two of the wall sections in heat transfer relationship with the inside surface for controlling heat transfer from the inside surface of the wall;

an inlet port formed extending from the outside surface of one wall section into the wall;

an outlet port formed extending from the outside surface of one wall section into the wall;

an internal cooling circuit extending between the inlet port and the outlet port, the cooling circuit including first and second channels, the first and second channels each having a first end connected to the inlet port, and a second end connected to the outlet port, the first channel extending through the wall sections from the inlet port to the outlet port in a first direction, the second channel extending through the wall sections from the inlet port to the outlet port in a substantially opposite direction from the first channel such that in operation flow though the first and second channels are in opposite directions.

23. (New) A heat transfer apparatus according to claim 22 wherein the first ends of the first and second channel are connected to the inlet port through a splitter, and wherein the splitter is formed in the same wall section as the inlet port; and wherein the second ends of the first and second channel are connected to the outlet port through a splitter, and wherein the splitter is formed in the same wall section as the outlet port.

24. (New) A heat transfer apparatus according to claim 22 wherein the inlet port and the outlet port are formed in the same wall section.

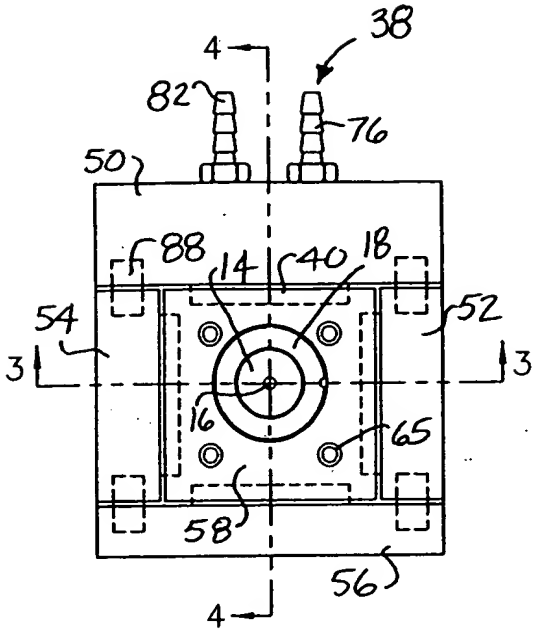
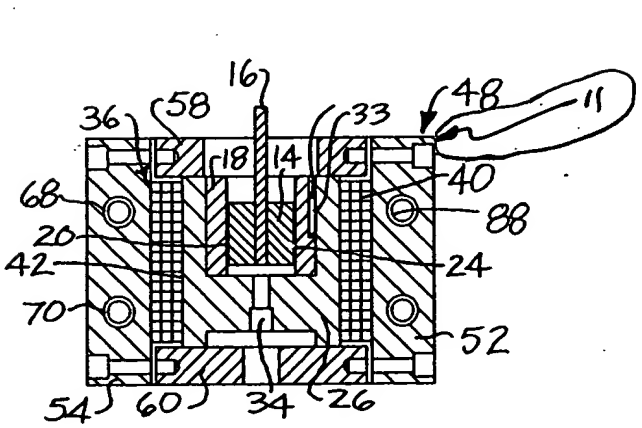


FIG. 2



Red marked

FIG. 3

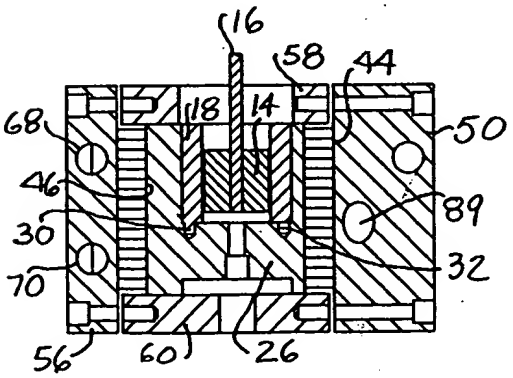


FIG. 4